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February 28, 1963

Taylor B. F.

STATINTL

TO:

FROM:

SUBJECT: Window Group Activities - 2/22/63 - 2/27/63

128-4649
COM/ OF 2

A leak tight 7 x 10 window was temperature cycled a total of 14 times under a pressure differential of 1/2 atm. The seepage of the quartz which was quite extensive during similar testing of a previous window appears to have been reduced very considerably. It was noticed, however, that between the 7th and 14 cycle, extensive cracking of the aluminum had occurred. These cracks are adjacent to the ultrasonic welds on the quartz, and for the most part are directed transversely to the weld line. The welds themselves appear to be unaffected. It is felt that the cause of the cracks is a fatigue failure of the aluminum due to the cyclic thermal stresses, and that a possible solution to the problem may be found by prior annealing of the aluminum and/or periodic exposure of the quartz-aluminum seal to a 500°F annealing temperature during usage. Experiments to explore these avenues are now in progress.

Another practice plate glass 14 x 20 window was made and the problems associated with the attachment of the curved tube have been eliminated.

The environmental chamber is in the process of being fitted with piping necessary to begin conducting outgassing and vac-ion pump tests.

Two additional tight 14 x 20 foils were received from Taylor-Winfield. The leak detector at Taylor-Winfield is being repaired this week, and production of additional frames will be continued next week.

A visit to Hamilton Standard was made by R. Stoll and [redacted] to discuss the possible applications of electron beam welding to the various forming processes required in the manufacture of the window. The results of this visit are discussed in detail in [redacted] trip report.

Attempts to increase reliability of bellows attachment are continuing. Our latest efforts have yielded four tight seals in six attempts, with good consistency of flow, and absence of discoloration, cracking and burning in the braze area.

RS:lc

ENCLOSURE
OXC-4649
COPY OF

STATINTL

FROM:

SUBJECT: Visit to Hamilton Standard made
by [REDACTED]
February 26, 1963.

DATE February 26, 1963

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STATINTL

[REDACTED]

When we arrived at Hamilton Standard, we found that they had done no work on our problem other than thinking about the techniques they could use for welding the bellows to the invar foil. After a brief discussion, we agreed to provide them with bellows which were pressed over onto the foil to make intimate contact. This is one of their prime requisites for a good electron beam weld.

They then took us to the welding equipment and demonstrated their procedure for obtaining an invar-to-aluminum weld. They were not able to achieve the proper settings for a good weld, but agreed to continue their efforts. They also agreed to provide us with a square area seal that we could vacuum test.

We discussed the possibility of producing an aluminum-to-glass weld by electron beam techniques. They discounted this possibility completely, but offered the information that work of this sort was being carried out at the Broadbrook plant. Claus agreed to visit us Friday afternoon, March 1, with information as to the Broadbrook operations. We agreed to provide him with a written request for additional work, that he could use as a basis for quoting us on this additional effort. He also, at that time, would indicate their success on the aluminum-to-invar weld.

STATINTL

HDP/jas

cc: [REDACTED] Rof

ENCLOSURE
DXC-4649
COPY OF

STATINTL

TO:

FROM:

SUBJECT: Window Group Activities - 2/15/63 - 2/21/63

A leak tight 7 x 10 window (including curved tube) was completed this week. This window will be used for extensive thermal testing which is expected to commence within a few days.

The plate glass 14 x 20 window which was fabricated for practice purposes has been completed. The low thermal conductivity mount and cooling fins have been attached and appear to fit satisfactorily. Some difficulties were experienced in the attachment of the curved tube. These difficulties are primarily ones of jiggling and modification of our present jiggling to overcome these difficulties is currently in progress.

Another plate glass 14 x 20 window is currently being fabricated and if no further difficulties present themselves during this assembly a full size quartz window will subsequently be made.

Work is continuing in an effort to improve the reliability of the bellows attachment.

Additional 14 x 20 frames are currently being made at Taylor-Winfield in an effort to build up our stock.

Two completed vac-ion power supplies have been made.

The use of a glow discharge technique as a means of outgassing our vacuum window is being investigated.

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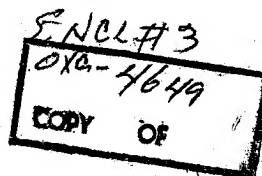
February 14, 1963

STATINTL

TO:

FROM:

SUBJECT: Window Group Activities 2/8/63 - 2/14/63



The 7 x 10 window which was reported last week was welded and is still awaiting attachment to the curved tube. The curved tube has not been attached because the equipment and personnel required for this work have been engaged in the more pressing problem of finalizing the bellows attachment of foil problem. With regard to the bellows attachment problem, although we have significantly refined and improved our techniques, we still have not arrived at a procedure using the brazing alloys which we feel are desirable and accomplishing a braze which we consider satisfactory. The results are encouraging enough to make us feel that we are nearing success. As an interim measure, we substituted a BT braze for the higher melting lithobraze. The two test samples we have done so far were good. We are going to make one more before using this technique to attach a bellows to our good 14 x 20 frame. This frame is the one that is going to be used for making a quartz and glass window.

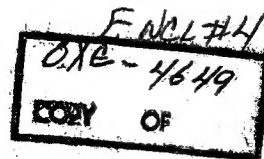
Another 14 x 20 window is being fabricated primarily for the purpose of practice prior to making the good one. This window has progressed to the point where both coated pieces of glass have been satisfactorily attached. It is awaiting attachment of the curved tube and vacuum appendage. The low thermal conductivity mount and cooling fins will also be attached.

Considerable effort was spent in preparing our test facilities for temperature cycling, leak checking, vacuum testing and outgassing both the 7 x 10 and 14 x 20 configurations.

PFF:lc



February 7, 1963



STATINTL

TO:

FROM:

SUBJECT: Window Design Development - 2/1/63 - 2/7/63

The intensive effort last week in Cape produced very good results. We have seemingly solved the problems associated with attaching the aluminum to the frames. We were able to produce two tight 7 x 10 frames with protected aluminum, one tight 14 x 20 frame with protected aluminum and one 14 x 20 frame which had a minute leak rate of 2.4×10^{-8} cc/sec He under the test conditions of 1/20 atm. He differential. Barry and Peter are planning to leave for Ohio on Monday to continue to build up a back log of 14 x 20 frames.

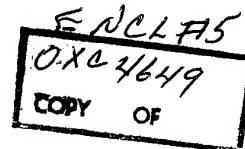
The bellows problem has still to be solved in what we feel is an adequate manner. We were able to get occasionally tight seals but do not consider the processes or results adequate. The effort is being intensified and shall continue over the weekend in an attempt to finally complete this last problem area by the beginning of next week.

One of the tight 7 x 10 frames is being used for making another tight testable 7 x 10 window. The bellows and ribs have been attached satisfactorily. The BK-7 was attached this morning and produced a weld which visually appeared as good as any we have ever made. This is using protected aluminum. The fused silica is being applied with a double weld this afternoon. As soon as the curved tube is attached to this unit it will be temperature cycled under simulated operating conditions employing the vac ion pump.

Construction of the first 14 x 20 configuration has begun. A frame is awaiting an adequate solution to the bellows problem. However, a practice frame is being carried through the entire process and shall be completely welded to plate glass and assembled first as a necessary preparatory procedure to making the first good full size window.

STATINTL

PFF:lc



MEMORANDUM

STATINTL

TO: .

DATE: January 31, 1963

FROM:

SUBJECT: Window Group Activities - Period 1/24/63 to 1/31/63

CC: All Group Leaders

Vacuum Window

The tight 7 x 10 window was temperature cycled through the mission profile 9 times. It was leak checked after this cycling and indicated no leak. It was decided to soak the assembly in helium for a long period as a more severe type of leak test. It indicated a leak rate of 1.2×10^{-8} cc per second.

The next 3 cycles of this configuration were done with a 1/3 atmosphere pressure differential between the gap and the outside environment, to simulate actual conditions. After this test, its long term leak rate was 30×10^{-8} cc per second. The calculated allowable leak rate, in use, which our VAC-ION pump is expected to overcome, is 750×10^{-8} cc per second.

Efforts are now being directed to produce another testable 7 x 10 and a 14 x 20 configuration. The two primary problems at this point are associated with aluminum attachments and bellow attachments. Neither process is fully under control at this time.

A double (concentric) weld on the 14 x 20 plate glass sample was made and was tight. Investigation of rewelding and salvage is being conducted. It has been decided to postpone an attempt to eliminate chipping during ultrasonic welding until after the next 7 x 10 is welded.

The pumping device for the 7 x 10 test window is completed and leak tight with the exception of the G-P valve which still must be added.

Miscellaneous

Alternate seal program-preliminary checks with a stainless steel (teflon coated) "O" ring were made. This ring was of the self energizing type. The seal leaked badly under all screw torque and was terminated when the "O" ring deformed.

PFF/jas

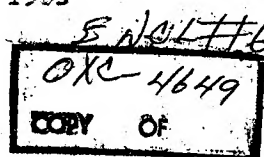
January 24, 1963

STATINTL

TO:

FROM:

SUBJECT: Window Group Activities - 1/18/63 - 1/24/63



Non-Vacuum Window

Test setup for obtaining information regarding the ability to seal an invar foil to glass with RTV, which is necessary for the new design of the non-vacuum window is being built. It is anticipated that these tests will begin next week.

Vacuum Window

A tight 7 x 10 vacuum window was temperature cycled nine times 0-500°F in accordance with the mission profile. Chipping of the quartz on the outside of the weld zone was noticed after three cycles. The window was leak checked and found to be tight after seven cycles, leak checking after nine cycles seemed to indicate the inception of extremely slight (1.2×10^{-8} cc/sec) leakage. This test will be continued and a complete report will be issued at its conclusion.

A tight 14 x 20 vacuum to glass double weld was made. This is significant in that it represents our first successful effort in this length weld.

STATINTL

[REDACTED] are at Taylor-Winfield attempting to increase the reliability of the vacuum to invar resistance welding. As of this date Paul reports no significant progress in this regard.

We are attempting to increase the reliability of our bellows to foil brazing by closer monitoring of the brazing temperature. There is a possibility that our difficulties may be due to a thermal coefficient mismatch between the bellows and the foil. A technique for overcoming this difficulty has been discussed and will be tried very shortly.

The fabrication of all equipment which is necessary for the thermal cycling test of the 7 x 10 window including supporting structure for vac-ion pump, flange and copper gasket assembly is progressing satisfactorily and should be completed by next week.

Investigations of alternate sealing techniques are continuing on a low priority basis; thus far results with gold plated Gask-O seals have been unsatisfactory. A tight glass to metal seal using a coined copper gasket was fabricated, but failed at approximately 200°F. As no fracture of the glass was noticed it is felt that this failure may have been due to loosening of the bolts. This seal technique will be explored more thoroughly as time permits.

RS:lc

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